HLA Object Model Development Process and Supporting Tools

Integrated Training Program

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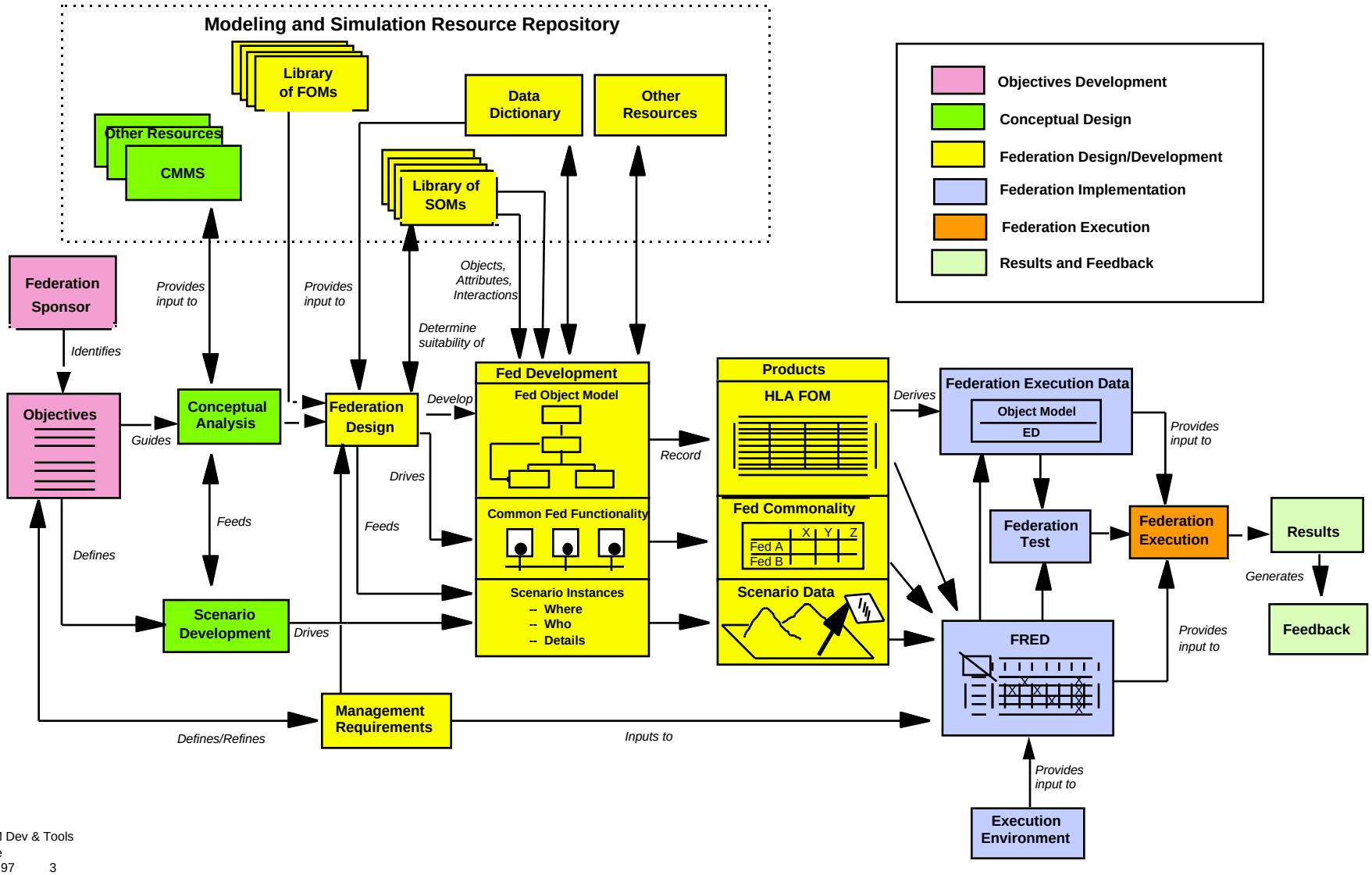
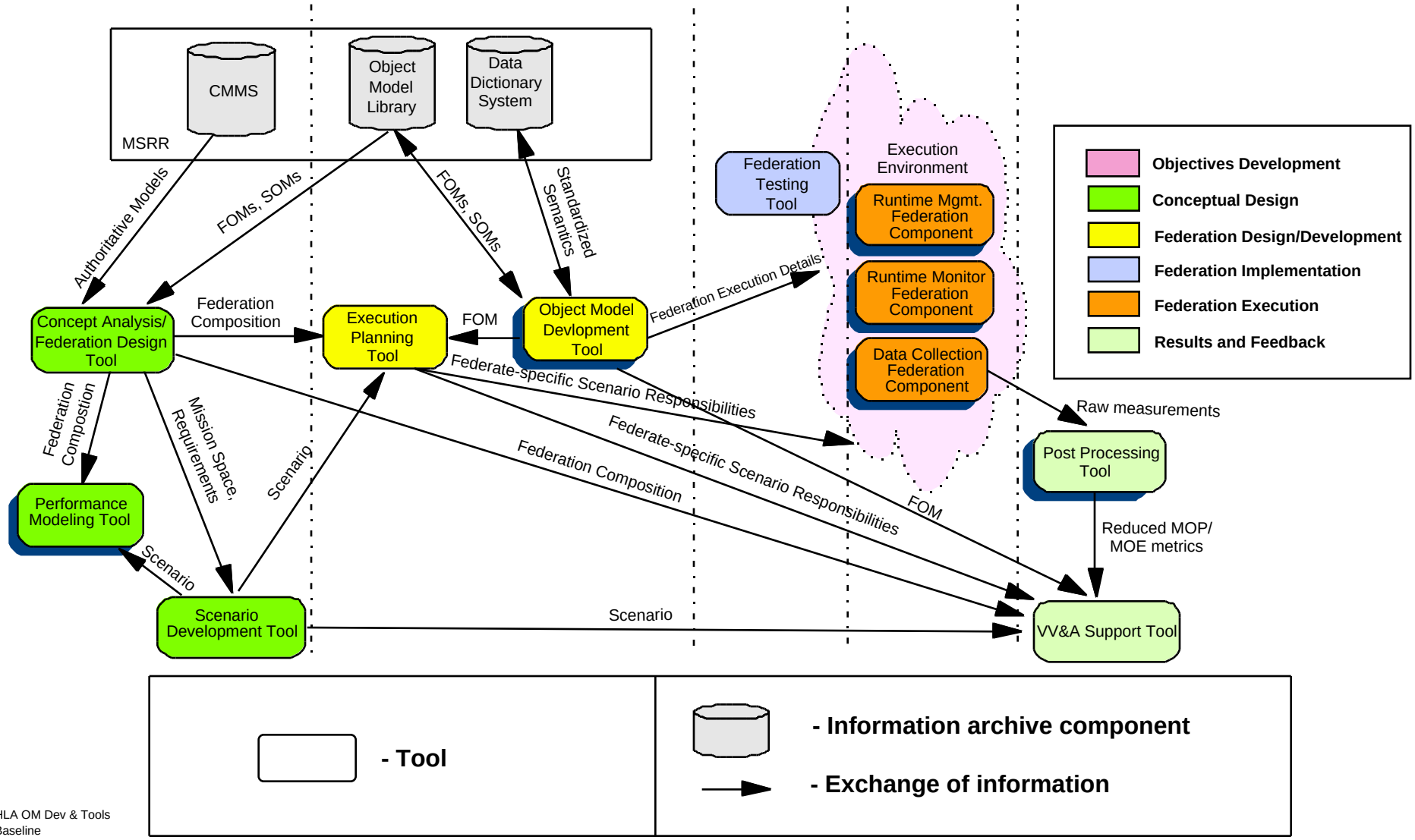
Introduction

- **Feedback from HLA protofederations emphasized need for process descriptions for HLA federation and object model development**
- **HLA Federation Development and Execution Process (FEDEP) model developed through cooperative effort between HLA protofederations and HLA TSTCore**
- **Sharing of OM development concepts among HLA protofederations (via the OMT Working Group) provided the foundation of the HLA Object Model Development Process**
- **HLA protofederation feedback also emphasized need for automated tools to support development processes**
  - **Led to development of the HLA Tool Architecture**

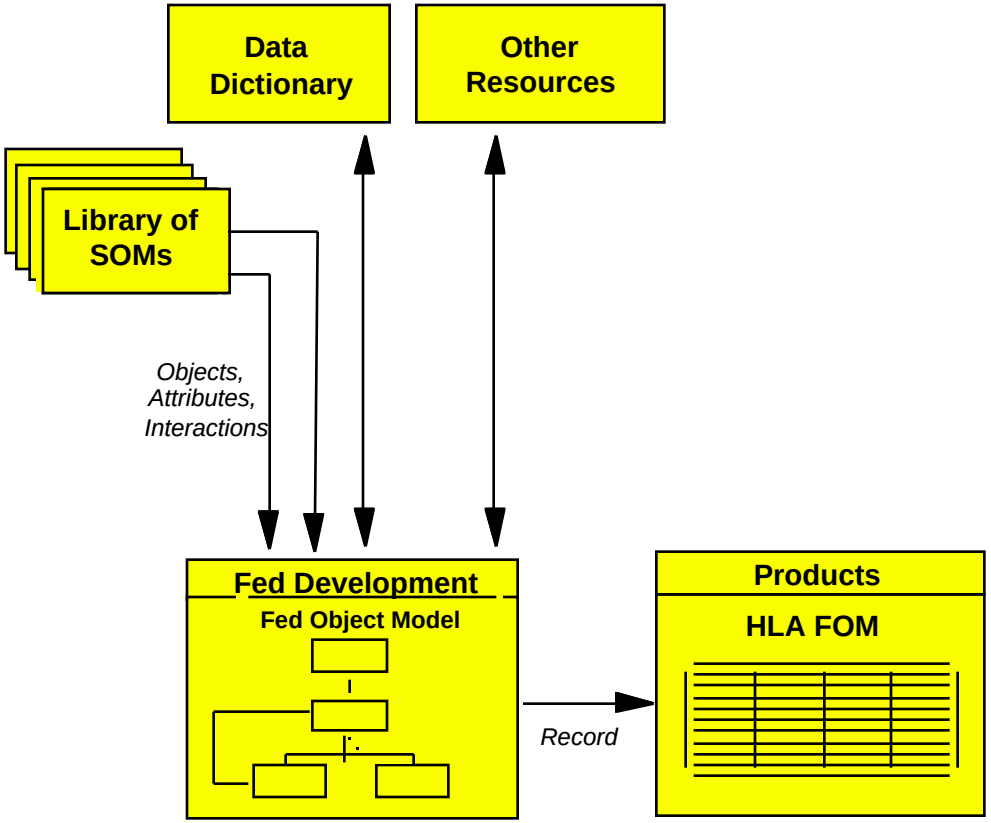
HLA FEDEP Model



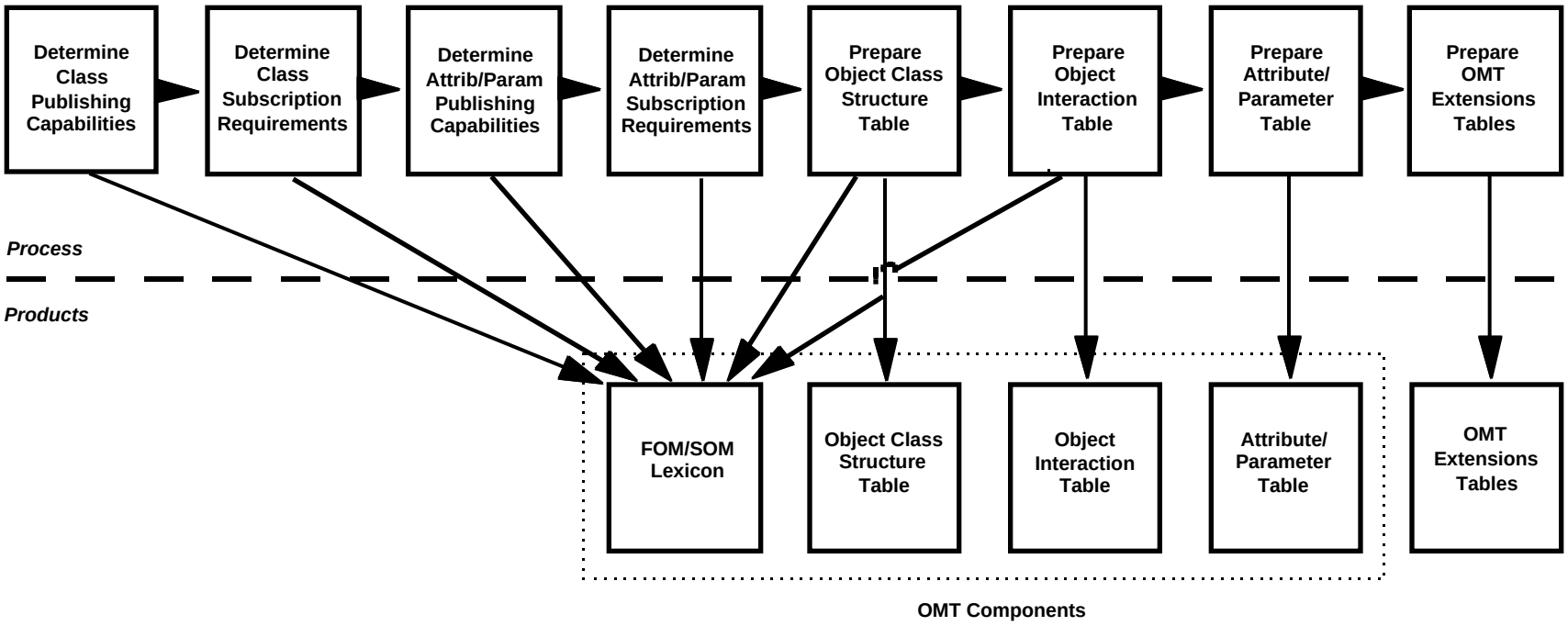
HLA Tool Architecture



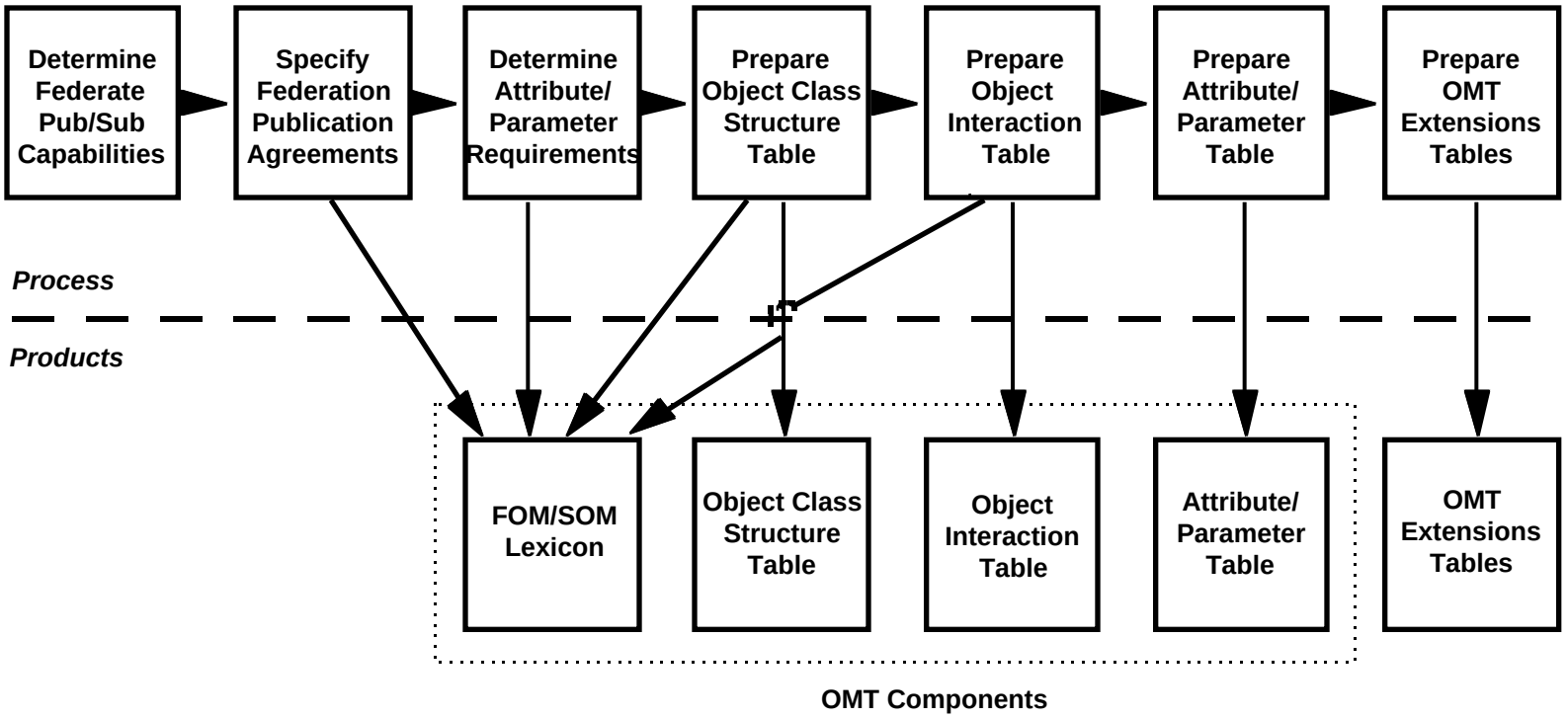
OM Development



SOM Development Process



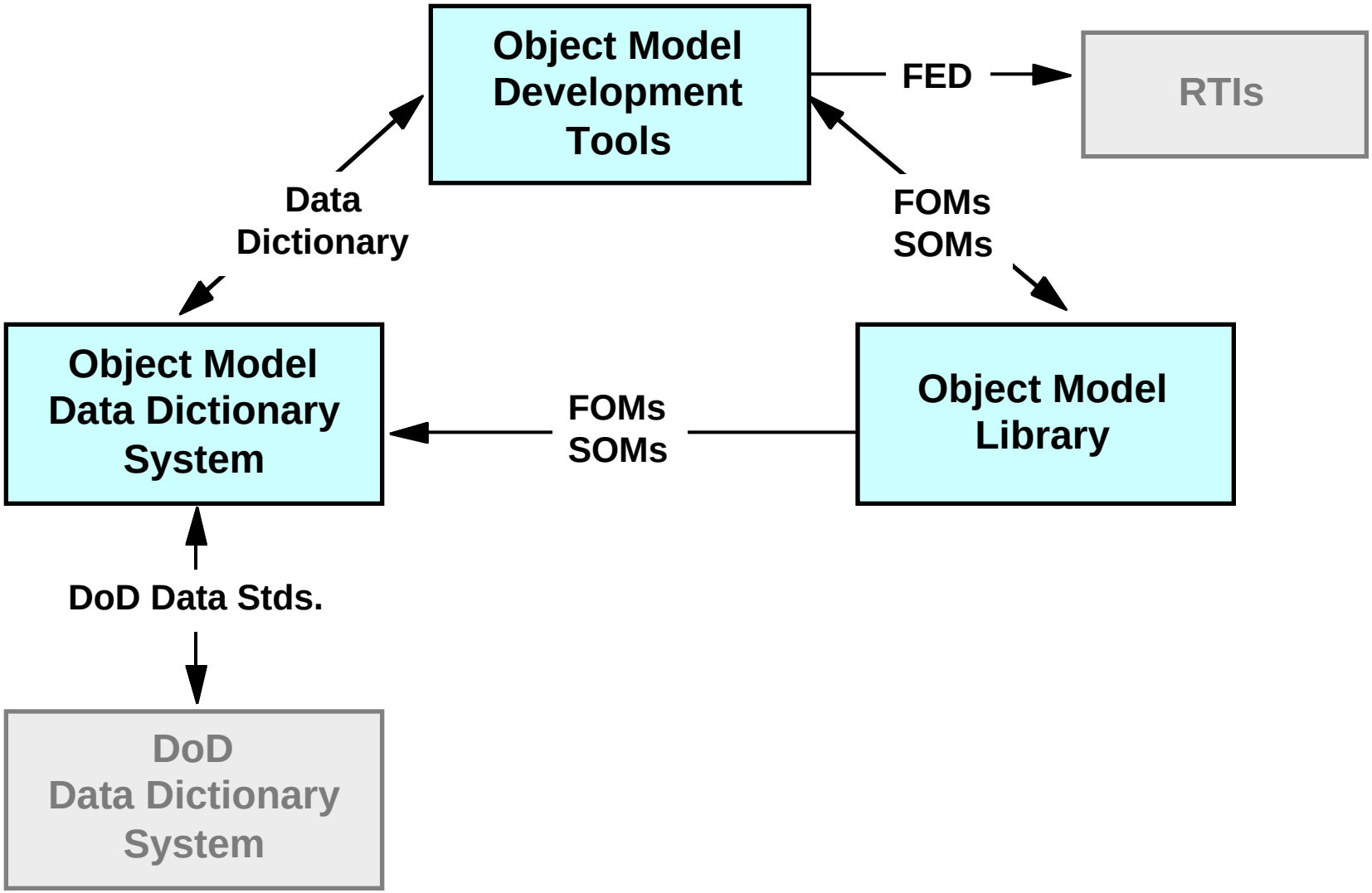
FOM Development Process



HLA Object Model Tools

- **DMSO is providing an initial, integrated suite of tools to support the development and management of HLA object models and OMDD contents:**
- **Object Model Development Tools (OMDTs)**
  - **Editors for the creation and modification of FOMs and SOM**
- **Object Model Library (OML)**
  - **A central repository to support the sharing and reuse of FOMs and SOMs**
- **Object Model Data Dictionary System (OMDDS)**
  - **A central repository of OMDD contents for use in creating FOMs and SOMs**

HLA Object Model Integrated Tools Suite



OMDTs

- **Purpose:**
  - Reduce manpower associated with FOM/SOM development
  - Provide integrated access to supporting resources
  - Automated production of Federation Execution Data (FED)
  - Maintain lowest possible learning curve
    - Intuitive user-interface
    - Help system and documentation
- **Common Features:**
  - Data entry/modification
  - Syntax/consistency checking
  - Automated OML/OMDDS access
  - FED generation
  - On-line help/documentation

AEgis OMDT

- Windows 95/Windows NT application
- Developed in Visual C++ using the Microsoft Foundation Classes
- Interface designed around HLA OMT tabular views
  - Supports in-place editing within cells and Win95 property sheet interfaces
  - Includes OMT extension tables
- “Smart” copy/paste maintains object model relationships
- Multiple Document Interface allows copy/paste between object models
- Interface for editing FED data (message order, delivery category)
- User’s Guide and Reference Manual integrated in Windows Help
- CDIF interface to COTS CASE tools

TASC OMDT

- **Standalone Java application**
  - **Requires Java Development Kit to run**
- **Multiple platforms**
  - **Unix, PC, Mac, ...**
- **Easy to use interface**
  - **Tabs to navigate to each table in the OMT**
- **OM Development Wizard**
  - **Guides the user through the OM development process**

HLA Object Model Library

- Provides a central repository for HLA Federation Object Models (FOMs) and Simulation Object Models (SOMs)
- Supports the Federation Execution Development Process (FEDEP) by
  - Making FOMs and SOMs accessible to anyone
    - FOMs and SOMs for specific applications
    - Reference FOMs
  - Supporting the reuse FOMs and SOMs
  - Providing pieces and parts for the creation of new FOMs and SOMs
  - Providing a basis for the comparison of semantic differences between/among multiple FOMs and SOMs

HLA Object Model Library Capabilities

- **Searching**
  - **across FOMs/SOMs**
  - **within names and the associated lexicon**
  - **user specified search scope**
    - **classes**
    - **attributes**
    - **interactions**
    - **parameters**
    - **complex data types**
    - **enumerated data types**
    - **associations**
- **Browsing within an individual object model**
- **Storage and retrieval of FOMs/SOMs using the Object Model Template Data Interchange Format**
- **Automated FOM/SOM interchange with Object Model Development Tools**
- **Registration of FOM/SOM owners (required to check in models)**

HLA Object Model Library Features

- **WWW-based application**
  - Compatible with any frames-capable web browser
  - Tested with Netscape 3.0 and Internet Explorer 3.0
- **Centralized database for object model storage**
- **Also accessible through a public call interface**
- **Extensive online documentation**
  - User support
    - Step by step user procedures
    - Linked to the Object Model Library Help Desk by email
  - Technical documentation
    - Object Model Template Data Interchange Format specification
    - Call interface description
    - Underlying database design

Accessing the Object Model Library

- Any user can browse, search, and check out models
- A Owner ID is required to check models into the Object Model Library
- Developers are free to write software to interface with the Object Model Library using the call interface

OMDD Rationale

- HLA is an architecture; it does not mandate standards for the content of FOMs and SOMs
- OMDD contents provide the common semantic and syntax for construction of complete FOMs and SOMs which:
  - Enhance the readability and understandability of FOMs and SOMs by using standard terminology
  - Results in reusable FOMs and SOMs (in whole or in part)
- OMDD contents are based on existing data standards where possible and establish new data standards where none exist:
  - Using the same semantics and syntax as the operational community
  - Supporting the M&S use of authoritative data sources using the same standards to describe and represent data
- OMDD contents are commonly developed from “reference” FOMs which support a broad M&S community

OMDD Building Blocks

- **OMDD contents establish a common set of building blocks for the construction of FOMs and SOMs including:**
  - **Classes**
  - **Interactions**
  - **Attributes/parameters (generic elements)**
  - **Complex data types**
  - **Enumerated data types**
- **The federation/simulation developer uses the OMDD contents to develop complete FOMs and SOMs by:**
  - **Developing class and interaction structures**
  - **Defining which attributes are needed for each class**
  - **Defining which parameters are needed for each interaction**
  - **Determining the receiving and affected classes for interactions**
  - **Defining associations between classes**

Relationship to Existing Data Standards

- **Where possible, OMDD contents are based on existing data standards from:**
  - **Defense Data Dictionary System (DDDS) - The DoD dictionary containing standard names, definitions, and representations for prime words (equivalent to object model classes) and data elements (equivalent to object model class attributes and interaction parameters)**
  - **Conceptual Models of the Mission Space (CMMS) Repository - A simulation independent representation of military operations**
  - **Universal Joint Task List - A breakdown of military operations tasks**
- **When no external data standards exist, new ones are defined and proposed to appropriate standards bodies**

OMDD Development

- **Initial OMDD contents are being developed in conjunction with three target programs:**
  - **Real-time Platform Reference (RPR) FOM - supports the transition of simulations from the Distributed Interactive Simulation (DIS) architecture to HLA**
  - **Engineering Federation FOM - extends the Engineering Protofederation work to support a broader community**
  - **Joint Training Confederation (JTC) FOM - supports the transition of simulations from the Aggregate-Level Simulation Protocol (ALSP) to HLA**
  - **Next, OMDD content will be developed to support additional Architecture Management Group-designated programs**
- **Then, the scope will be broadened to serve a larger sector of the M&S community**

Object Model Data Dictionary System (OMDDS)

- A web-accessible repository containing:
  - OMDD contents
  - Mappings between OMDD contents and external data standards
  - Mappings between OMDD contents and object models
- The OMDDS supports:
  - Searching and browsing the OMDD contents
  - Exporting a portion of the OMDD contents (for use with Object Model Development Tools)
  - Establishing new OMDD contents
  - Mapping OMDD contents to external standards and object models (FOMs and SOMs in the OML)

OMDDS User Categories

- **Simulation/Federation Developer**
  - Search and browse OMDD contents
  - Export custom subsets of OMDD contents via HLA OMDD DIF
- **OMDD Analysts:**
  - Create/update/delete OMDD contents
  - Export external standards (e.g., DDDS proposal packages)
  - Map OMDD contents to external standards
  - Map OMDD contents to initial OM references and OM usages
- **Administrator:**
  - Export OMDD contents via HLA OM Data Dictionary DIF
  - Create and maintain User ID information
  - Import/update external data standards
  - Make backups and restore from backups

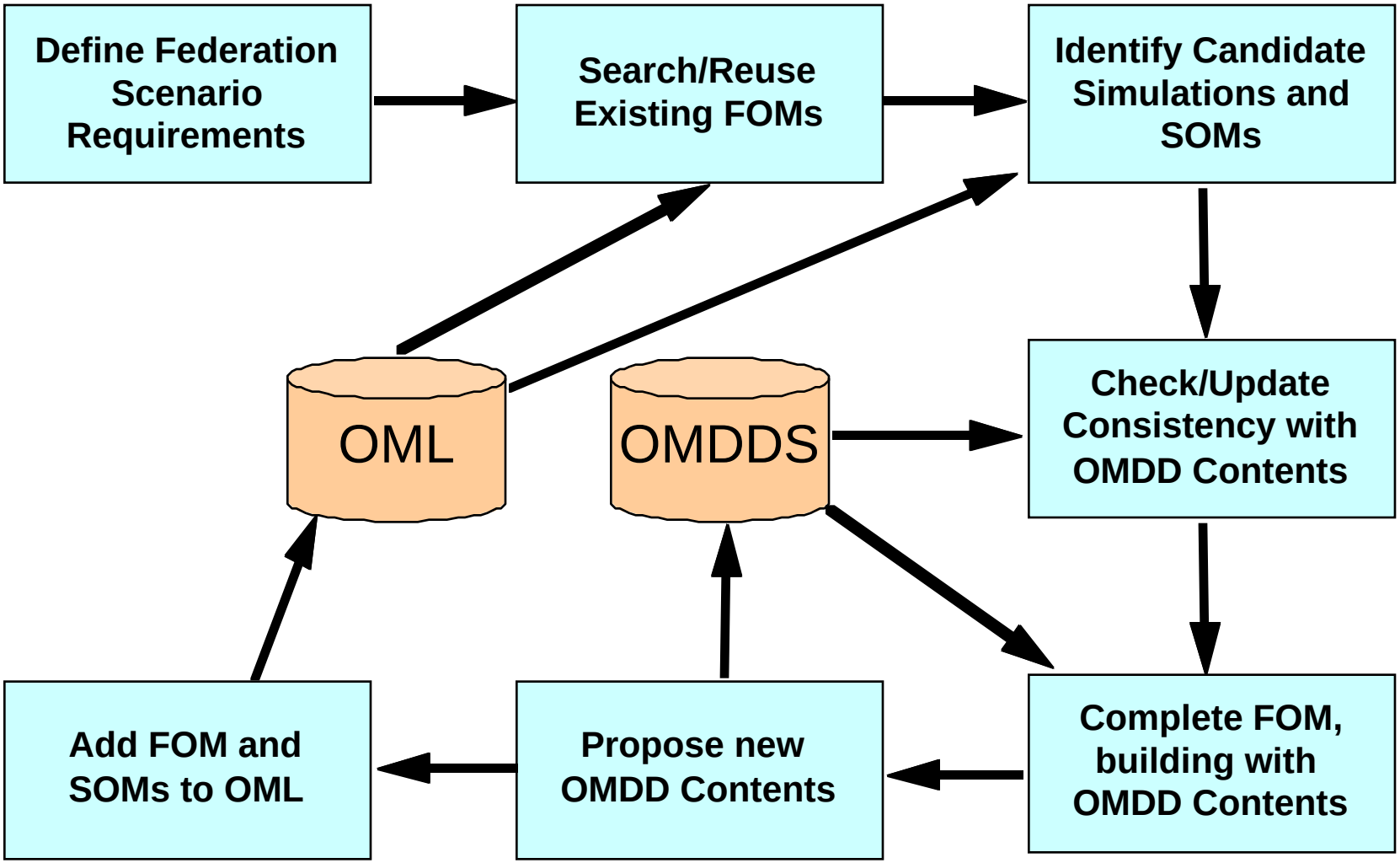
OMDDS Metadata Contents

- **OMDD Contents:**
  - **Classes**
    - **names, synonyms, definitions, and notes**
  - **Generic elements (attributes and parameters)**
    - **names, synonyms, definitions and notes**
    - **data type, units of measure (multiple representations)**
  - **Complex data types**
    - **names, fields**
  - **Enumerated data types**
    - **names, enumerators, representations, and notes**
  - **Interactions**
    - **names, synonyms, and notes**

OMDDS Metadata Contents (Cont'd)

- **Mappings to DDDS:**
  - **Subset of approved and candidate contents**
  - **Limited to contents germane to M&S**
  - **Prime words**
    - **names and definitions**
    - **equivalent to classes and interactions**
  - **Standard data elements and**
  - **Generic elements**
    - **names, definitions, domain, data type, units of measure**
    - **equivalent to attributes and parameters**
- **Mappings to CMMS Verbs:**
  - **verb names, synonyms, definitions**
- **Mappings to UJTL:**
  - **verb names, definitions**

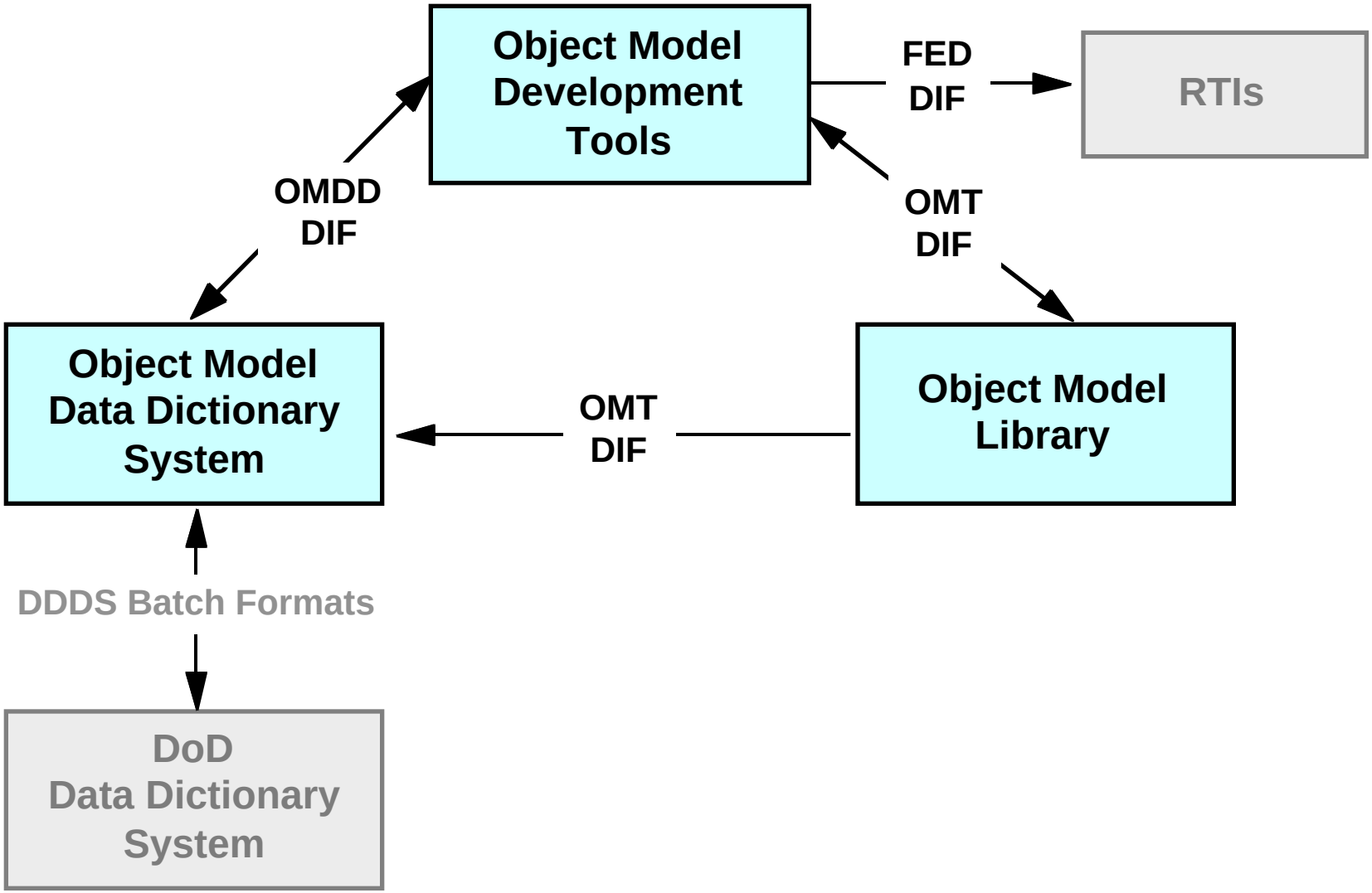
Use Case: Developing a New FOM



Data Interchange Formats

- A DIF is a specification of the semantics and structure of data to be interchanged between multiple data producers and multiple data consumers
- HLA DIFs are Backus Naur Form (BNF) descriptions of delimited ASCII text
- HLA DIFs support the interchange of object model information among HLA tools
- HLA DIFs provide an open specification for development of new object model tools which will integrate with the existing tool set

HLA DIFs


Object Model Development Tools
FED DIF
RTIs
OMDD DIF
OMT DIF
Object Model Data Dictionary System
OMT DIF
Object Model Library
DDDS Batch Formats
DoD Data Dictionary System

Access to the HLA OM Tool Suite

- AEgis OMDT and OML will be made publicly available in late October
- TASC OMDT and OMDDS will be made publicly available later this year, following further testing
- To find out more on release information:
  - watch the DMSO Home Page (http://hla.dmso.mil/) for release
  - subscribe to HLA_Online through listproc@msis.dmso.mil

Summary

- **Process models for HLA federation and object model development are continuing to evolve and mature**
  - **Basis for user guidance in OM and federation development**
- **Automated tools are critical throughout the HLA FEDEP to achieve usability and efficiency goals**
  - **Better use of simulation at lower cost**
- **HLA tool development is just beginning**
  - **Tool architecture and DIFs provide a framework for the development of GOTS, COTS, and contributed tools**